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NOTES ON THE COMPOSITION OF TALC.¹

WILLIAM F. FOSHAG, *U. S. National Museum*, AND EDGAR T. WHERRY, *Bureau of Chemistry*

The chemical constitution of talc is a problem that has engaged the attention of a number of investigators without the studies having led to a satisfactory solution. The analyses show a variation in the ratios Mg:Si from 1:1 to 4:3 and in the water content from 3 to over 7 percent. What this variation is due to is difficult to determine with our present data; altho the possibility of admixture is not entirely excluded, examination as to the homogeneity of the material analyzed seems rarely to have been made. The theoretical compositions for several ratios are here tabulated in order of increasing water content:

THEORETICAL COMPOSITIONS OF TALCS

H ₂ O:MgO:SiO ₂ =	1:4:5	1:3:4	2:4:5
H ₂ O	3.7	4.7	7.2
MgO	33.6	31.8	32.3
SiO ₂	63.5	63.5	60.5
	100.00	100.0	100.0

Material with approximately the composition given in the last column has recently been assigned the name "gavite."² Two occurrences of talc of low silica and high water content have been studied in the National Museum laboratory, with special reference to the latter constituent.

¹ Published by permission of the Secretary of the Smithsonian Institution. This paper was presented in abstract at the Chicago meeting of the Mineralogical Society of America, December 29, 1920, but the manuscript was mislaid and has only recently been found.

² *Atti. Soc. Ital. Sci. Nat.*, 57, 131-155, 1918; abstract in *Am. Min.*, 4, 132, 1919.

Some specimens of talc collected by Mr. Earl V. Shannon, of the Department of Geology, at the old Atwater serpentine quarry of the Westfield Marble Company in Russell, Massachusetts were investigated. The talc occurs as patches of silvery flakes of a light green color in a massive dark green serpentine and is evidently derived from some other mineral, probably olivine. The plates possess a good basal cleavage. The material for analysis was carefully selected, crushed and screened, and examined with a hand lens. Many of the fragments showed inclusions of magnetite. These were removed with a strong magnet and the sample, after further grinding, was examined with the petrographic microscope and found to be homogeneous.

The results of the analysis of this material, carried out by standard methods, and the calculated ratios are given below.

ANALYSIS AND RATIOS OF TALC FROM RUSSELL, MASS.

H ₂ O—	0.50		
H ₂ O+	7.28	420	4.00
SiO ₂	56.86	937	9.00
Al ₂ O ₃	1.00		
Fe ₂ O ₃	none		
FeO	2.40	33	
MnO	none		
CaO	0.46		
MgO	31.74	793	8.00
	100.24		

After standing for 23 days over sulfuric acid the mineral lost but 0.5 percent of water. Heated to dull red heat it lost 4.04 percent without losing its optical homogeneity. The water retained amounted to 3.24 or the theoretical amount required by the ordinary talc formula.

The feature of particular interest in this connection is the slight change which is produced in the optical properties by the loss of the first portion of water. The refractive indices of the original material, determined by the immersion method, are somewhat variable, as follows: α = from 1.540 to 1.545 ± 0.005 , $\beta = \gamma$ = from 1.575 to 1.585 ± 0.003 . Approximately the same values were obtained on the material from which the "loosely bound" water had been driven. The optic axial angle, $2E = 20^\circ \pm 5^\circ$, also remained essentially the same. The homogeneity of the

material was destroyed, however, when the firmly bound water was driven off.

A second specimen investigated was collected by Mr. M. Vonsen near Porterville, California. It occurs as small seams up to three centimeters in thickness with typical vein structure. The plates are arranged normal to the walls and meet in the center to form a suture. This talc is accompanied by calcite. The sample selected for analysis appeared homogeneous; its optical properties are as follows: axial angle small; negative; acute bisectrix normal to the plates; $\alpha=1.545$, $\beta=\gamma=1.574$. The refractive indices again vary somewhat from grain to grain. The analysis and calculated ratios are given in the following table:

ANALYSIS AND RATIOS OF TALC FROM PORTERVILLE, CALIF.

H ₂ O—	0.28		
H ₂ O+	7.76	431	4
SiO ₂	57.44	957	9
Al ₂ O ₃	none		
Fe ₂ O ₃	none		
FeO	1.85	26	
CaO	1.14	20	
MgO	31.74	793	8
	100.21		

Over sulfuric acid the mineral lost but 0.28 percent upon 23 days exposure. Lack of suitable material made it impossible to study the change upon dehydration.

As will be seen from the above data the water behaves in an unusual manner. One molecule of water is given off, at a high temperature, without bringing about any detectable change in the optical properties of the mineral. It differs, therefore from the so-called dissolved water, the characteristic feature of which is, that it is given off continuously with corresponding changes in the optical properties of the mineral. In common with dissolved water, however, the water of the talc studied appears to be present in molecular proportions. Other analyses of talc show a continuous series of gradation from Mg:H₂O=3:1 to 3:2, but do not go beyond these limits. Some analyses of talc show water content below the theoretical amount required for Mg:H₂O=3:1, but this can perhaps be attributed to the method of de-

termining the water: by ignition loss without a correction for the oxidation of the ferrous iron, which results in a low value.

Larsen and Wherry³ have described a leverrierite from Colorado that behaved in a manner similar to the talc. In this case, however, a large amount of water was given off at temperatures below 110°C, while the temperature required to drive off the first portion of the water from the talc was a dull red heat. The optical properties of the leverrierite up to the point of complete dehydration showed no appreciable change.

The constitution of talc containing only firmly bound water and approximating in composition the 1:4:5 ratio has been investigated by Clarke and Schneider.⁴ The driving out of the water resulted in setting free practically $\frac{1}{4}$ of the silica present, showing the mineral to be an acid metasilicate, representing as it were an enstatite with every fourth magnesium atom replaced by hydrogen. Neither enstatite nor this type of talc are appreciably dissolved by acids. In the case of the talc described above as well as the "gavite," the mineral is readily decomposed. The driving out of the loosely bound water, on the other hand, does not liberate any silica nor produce any marked change in the mineral here under investigation.

Talc belongs to the small but interesting group of minerals of such a low degree of hardness—lying at 1 or 1.5 in the standard scale of hardness—that they have a greasy feel and at the same time exhibit an eminent pinacoidal cleavage. Other noteworthy members of this group are: graphite, molybdenite, tetradymite, orpiment, nagyagite and pyrophyllite. Of these only graphite has been studied as to its crystal structure by X-rays, but the others are undoubtedly more or less analogous in structure. In the direction perpendicular to the cleavage face such substances are held together chiefly by electro-static forces rather than by valence forces (which yield much harder crystals; compare diamond).

Most of these are formed in nature at such high temperatures that they would hardly be expected to take up water; altho a hydrous arsenic sulfide corresponding to orpiment + 1H₂O has been reported, and pyrophyllite may carry several percent excess water.

³ *J. Wash. Acad. Sci.*, 7, 208, 1917.

⁴ *Am. J. Sci.*, 40, 306, 1890.

But if the temperature of formation were low enough, more or less water might readily become interlayered with the normal mineral molecules, in the direction of the perfect cleavage. The properties of this water should be intermediate between those of water (hydrogen or hydroxyl) held by valence forces in the compound, and those of water held as such by surface forces. The temperature at which the water would escape should be greater than the boiling point of free water yet less than that required to break down the compound. Its presence should render the molecules more susceptible to attack by reagents. Its escape would result only in a slight shrinking together, in the pinacoidal direction, of the solid layers and hence should not produce any marked change in optical properties. These features are shown so definitely by the two talcs here studied, that their excess water is considered to be thus held, i. e., by electrostatic attraction between the mineral layers in the cleavage direction. The new mineral "gavite" as well as the long known mineral "picrosimine," are so analogous in composition to the talcs described above as to leave no doubt that they are similar, and as such do not deserve the rank of distinct mineral species. It is therefore suggested that these two names be dropped and that these minerals be included under the species talc.

NOTE ON GARNET FROM A PEGMATITE IN IDAHO¹

EARL V. SHANNON, *U. S. National Museum*

While studying black sands from the Idaho gold placer mines the writer recognized that the garnet occurring in these concentrates was of two kinds, distinguished by a pronounced difference in color. The first of these, which is brown red in color was called almandite. The other garnet is rose red in color and in a recent publication it was stated that this was probably a magnesian variety high in the pyrope molecule, and perhaps derived from basic magnesian metamorphic rocks. This idea was a result of the writer's observation of a garnet of similar color and appearance in an amphibolite schist derived from large diabase sills in the Avery Quadrangle in the Northern part of the state. A number of specimens of garnet in matrix from Idaho have since been examined and it seems that this rose colored garnet is the

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commonly occurring garnet in the pegmatites which are connected with the great granitic batholith of central Idaho. As contrasted with the metamorphic garnets of the amphibolites these are all notably manganiferous, and measurements of refractive index seem to indicate the essential identity of the garnet in pegmatites from widely separated localities with each other and with the garnet of similar color in the heavy sands.

As typical of these pegmatite occurrences of rose colored garnet there was selected a specimen (Cat. U. S. N. M. 91, 223) from the Luella mica mine near Avon, Latah County which was received from Dean Francis A. Thompson of the Idaho State School of Mines through Mr. Frank L. Hess. Mr. Thompson states that the garnet is typical of that occurring in the mica bearing pegmatites of that area. The specimen consists of coarse-grained pegmatite containing muscovite, feldspar, quartz and abundant black tourmaline in addition to the garnet. The garnet is purplish rose-red in color and is much traversed by cracks which render it friable, granular and somewhat opaque. It forms grains or imperfect trapezohedral crystals up to 1 cm. in diameter imbedded in quartz or in mica, the most perfect crystals being those which are surrounded by muscovite. There is no flattening of the garnet crystals between the laminae of mica.

A sample carefully selected and purified by the use of an electromagnet and heavy solutions was analyzed yielding the results and ratios given below:

ANALYSIS AND RATIOS OF GARNET FROM IDAHO

CONSTITUENTS	PER CENT		RATIOS	
SiO ₂	35.84	.5944	59.44	1.00×3
Al ₂ O ₃	21.20	.2074	20.91	1.06×1
Fe ₂ O ₃	.28	.0017		
CaO	trace			
FeO	27.84	.3875	61.53	1.04×3
MnO	14.33	.2020		
MgO	1.04	.0258		
Total	100.53			

These ratios yield the garnet formula, 3RO.R₂O₃.3SiO₂. The small amount of ferric iron cannot be present as the andradite molecule (Ca₃Fe₂(SiO₄)₃) which is the only recognized molecule containing iron in the trivalent state as the amount of lime

required (0.29%) does not occur in the mineral. Grouping the ferric iron with the alumina in the almandite molecule the garnet has the following molecular and percentage compositions:

	MOLECULAR RATIO	WEIGHT PER CENT.
Almandite	1292	63.61
Spessartite	673	32.95
Pyrope	86	3.44
TOTAL	2051	100.00

The measured index of refraction of the analyzed powder is 1.818 while the calculated value for a mixture of the above composition, based upon Ford's data for the end members of the group, is 1.816, the two agreeing within the limit of error.

THE CRYSTALLOGRAPHY OF ANTIMONY TRIBROMIDE

CHESTER B. SLAWSON, *Ann Arbor, Michigan*

Antimony tribromide is a very highly deliquescent salt which rarely forms in well developed crystals. Crystals of the halogen salts of antimony were first described by Cooke¹ who prepared his material while investigating the atomic weight of antimony. The crystals described in this paper were obtained from R. K. McAlpine,² of the Department of Chemistry, who has recently revised the atomic weight determination of Cooke.

The crystals were formed by subliming powdered antimony tribromide in a sealed glass tube which had been exhausted to a pressure somewhat under 1 mm. Upon volatilization the material was deposited in the cooler portions of the tube generally in the form of long, slender, interlacing needles. In a few of the tubes, however, small well-developed crystals were found together with the customary deposit of acicular masses. After a period of several months a considerable growth in the size of these small, well-developed crystals was noted and in some of the sealed tubes crystals appeared where previously none had been observed. These continued to grow and at the end of a year and a half the larger crystals measured 8 by 4 by 3 mm. They were perfectly

¹ Cooke, *Proc. Am. Acad. Arts Sci.*, 13, 74, 1877.

² Willard and McAlpine, *J. Am. Chem. Soc.*, 43, 797, 1921.

transparent and possessed a high adamantine luster and dispersion similar to that of the diamond. The growth of these crystals is analogous to the growth observed in solutions when well developed crystals are formed at the expense of the smaller ones.

Upon exposure to air in the laboratory the mirror-like faces soon became blurred and in short time the crystals themselves dissolved in the moisture they had extracted from the atmosphere. To overcome this difficulty a special moisture free chamber was constructed.³

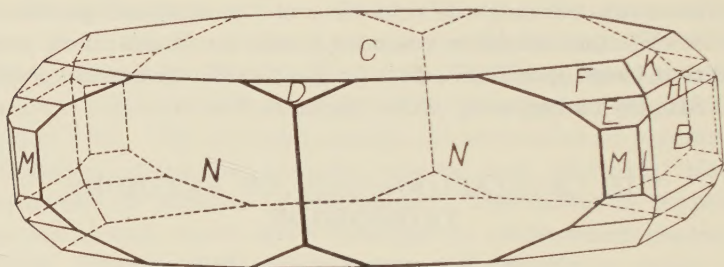


FIG. 1. Antimony tribromide showing prismatic development

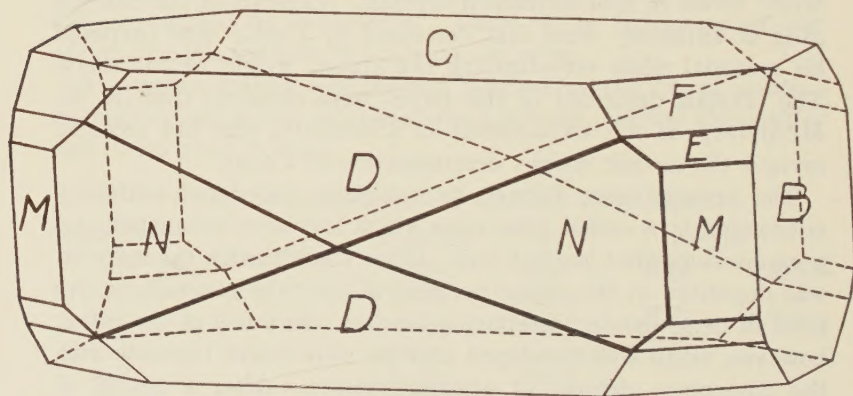


FIG. 2. Antimony tribromide showing equal development of prisms and macrodomes

Antimony tribromide crystallizes in the orthorhombic bipyramidal class. Two habits were observed as shown in Figures 1 and 2. Fig. 1 shows the prismatic habit with well developed

³ An apparatus for handling deliquescent crystals, *Am. Min.*, 7, (2), 25, 1922.

brachydomes, while Fig. 2 illustrates the equal development of the prisms and the macrodomes. The following forms were observed: C(001), B(010), M(110), N(310), L(120), H(021), K(052), D(101), E(111), and F(221). There were also a few small imperfectly developed faces which gave no distinct signal. The computed axial ratio was, $a : b : c = 0.7808 : 1 : 1.1645$.

	OBSERVED READINGS	CALCULATED VALUES
B:M (010):(110)	52° 1'	X
C:D (001):(101)	56° 10'	X
B:N (010):(310)	75° 20'	75° 24'
B:L (010):(120)	31° 48'	32° 38'
C:E (001):(111)	27° 32'	27° 52'
C:K (001):(052)	67° 4'	66° 46'
C:H (001):(021)	71° 8'	71° 2'
E:F (111):(221)	18° 45'	18° 43'

Complete optical orientation with reference to the crystallographic axes was not possible but upon a number of crushed crystal fragments the emergence of an optic axis could be observed. The substance is optically negative and the large number of rings gave evidence of its extremely high double refraction. Parallel extinction was also noted so the crystals undoubtedly belong to the orthorhombic system. Crystals kept in a desiccator containing calcium chloride for one week became coated with a fine white powder of the oxybromide. When this powder was removed good etch figures were observed upon the prisms and macrodomes showing the presence of planes of symmetry parallel to the brachy- and basal pinacoids, but no etch figures were observed which indicated the presence of a plane of symmetry parallel to the macropinacoid. The substance probably belongs to the bipyramidal class. Immersed in methylene iodide the fragments stood out in good relief indicating that the indices of refraction were considerably higher than that of the liquid (1.74). An unusually good cleavage was observed parallel to the brachypinacoid.

NOTES AND NEWS

Mr. William F. Foshag, who has been taking post graduate work at the University of California, has returned to the U. S. National Museum. We hope soon to be able to publish accounts of some of his visits to western mineral localities.

Mr. Samuel G. Gordon of the Philadelphia Academy of Natural Science has recently spent some time collecting rare-earth minerals around Spruce Pine, North Carolina.

We regret to note the death of Sir William P. Beale, former president of the Mineralogical Society (Great Britain) and of Professor Hjalmar Sjögren, the eminent Swedish Mineralogist.

The list of appointments to science research scholarships (overseas) made by the British Commissioners includes the name of Miss M. Bentivoglio, who has received a scholarship in crystallography.

At the sixty-third annual commencement of Cooper Union, Brooklyn, New York, the degree of Chemical Engineer was conferred upon Wallace Gould Levison, a member of the night class of 1865.

The following National Research Council Fellowships along mineralogical lines have been awarded: Correlation of some optical and electrical properties of crystals, Joseph Valasek, University of Minnesota; and Factors influencing the intensity of reflection of X-rays from crystals, R. G. Dickinson, California Institute of Technology.

We are pleased to note that a well-known English mineralogist, Mr. A. Hutchinson, of Cambridge University, has been honored by being elected a Fellow of the Royal Society.

M. Pruvost has been appointed to the newly established chair of geology and mineralogy at the University of Lille.

BOOK REVIEW

PETROGRAPHY AND MINERALOGY OF THE LIMESTONE DEPOSITS OF PARAINEN (PARGAS). (*Bull.* 54). AARNE LAITAKARI. 114 pages. *Commission geologique de Finlande, Helsingfors.* (1921).

This pamphlet presents an interesting account of a famous Finnish mineral locality. The region is underlain by igneous rocks, granite, migmatite—a mixture of granite with more or less of the invaded schist—pegmatite, in part with assimilated limestone, and diabase; and metamorphic rocks, comprising the gneiss of the migmatite, limestone, quartz or wollastonite-bearing limestone, calcareous gneiss, amphibolite, and grossularite-diopside rock. The minerals present include: graphite, in most of the limestone quarries; galenite, rare; pyrrhotite, general; chalcopyrite, rare; pyrite, unknown in the main limestone body, but in one small mass being present instead of pyrrhotite; loellingite, in small grains with scapolite in the Ersby quarry; arsenopyrite, occasional; fluorite, widespread, of intense purple color; a quartz; ilmenite, rare; spinel, of 2 kinds, dark, with sp. gr. = 3.841, and μ 1.727, containing Ti, and light, with sp. gr. 3.682 and μ 1.718; calcite, rarely crystallized; dolomite, occasional; microcline, abundant in pegmatite,

crystallographic data being given; plagioclase, comprising oligoclase, andesine and anorthite; diopside, ranging from clear gray to green and black, analysis of the latter giving: SiO_2 49.70, Al_2O_3 1.73, Fe_2O_3 4.76, FeO 10.61, MgO 9.61, CaO 22.67, K_2O 0.19, Na_2O 0.43, TiO_2 0.43, H_2O 0.13, sum 100.26%. This is thus not augite as the color might indicate, but an Fe-rich diopside. Its indices are: α 1.692, β 1.699, γ 1.721; $\gamma - \alpha = 0.029$, $2V = 59^\circ 44'$, sp. gr. 3.42. Other analyses are quoted and crystallographic data given. Wollastonite is common as a contact mineral. Amphibole occurs in 2 forms, tremolite, in small amount but widespread, and pargasite, which is named after the locality and shows many noteworthy features. Detailed crystallographic data are given, as well as determinations of indices and sp. grs. on 5 different occurrences, the range in indices being α 1.613 to 1.640, β 1.618 to 1.646, γ 1.635 to 1.659; sp. gr. 3.069 to 3.189. Four new analyses on the material worked up crystallographically and optically are given. Analyses 1 and 3 respectively give: SiO_2 42.05, 48.10; TiO_2 0.91, 0.10; Al_2O_3 12.60, 11.05; Fe_2O_3 1.60, 0.67; FeO 11.51, 1.65; MgO 13.48, 20.60; CaO 11.85, 12.50; K_2O 1.90, 1.24; Na_2O 1.97, 2.54; H_2O 0.41, 0.71; F_2 1.82, 1.90; $\text{H}_2\text{O} -$ 0.07, 0.11; sums 99.41, 100.37%. In explaining the compositions of amphiboles Penfield and Stanley assumed the presence of radicles such as $(\text{MgF})'$, $(\text{Al}_2\text{OF}_2)''$, $(\text{MgOH})'$, $(\text{Al}_2\text{O}(\text{OH})_2)''$, etc. As the H_2O escapes without decomposition of the mineral or loss of transparency, resulting merely in slight increase in indices, it must be present not in such radicles, but in dissolved form. Using the data and method of Ford it is found that the curve of mean index against SiO_2 is in pargasite always below that for normal amphiboles, while the Al_2O_3 curve is correspondingly higher; the curves for total Fe, MgO , $\text{Na}_2\text{O} + \text{K}_2\text{O}$ and CaO agree essentially with those for normal amphiboles. This demonstrates clearly that in pargasite there is mutual replacement of SiO_2 and Al_2O_3 . Garnet-grossularite occurs in the limestone, giving indices from 1.742 to 1.760; 2 analyses are quoted, showing it to contain about 70% of the grossularite mol. Partial analysis of the same mineral in the garnet-diopside rock gave CaO 29.38, MnO 0.40, FeO 4.27, corresponding to 63% grossularite; the $n = 1.774$. Another garnet, almandite, occurs in the migmatite. Scapolite is of general occurrence in the limestone, and is the richest in forms of all known occurrences. A large number of crystals are described, the new forms recognized being (310), (301), (611), (211), (112), (332), and uncertain (411), (641), (631), and (212). The n_s were detd. as ranging: ω 1.581 to 1.597, ϵ 1.551 to 1.559; by plotting these values, something as to the composition of the several occurrences can be made out, both CO_2 -rich and normal scapolites being represented. Vesuvianite occurs both as a contact mineral in the limestone and in pegmatite, in the latter having ω 1.726 and ϵ 1.721; zircon occurs in biotite and in gneiss. Other silicates described are epidote, allanite, prehnite, chondrodite, tourmaline, muscovite, biotite, phlogopite, clintonite, serpentine, talc, and titanite. Apatite is a common mineral in the limestone; its indices are ω 1.634, ϵ 1.631. Partial analyses show that it is a fluorapatite, with about 0.1% Cl and 0.45 to 0.65 CO_2 . Finally the so-called pyrralolith and ersbyite are discussed and their indefinite character affirmed. The contact phenomena and the paragenesis of the minerals are described in detail, and an elaborate bibliography is appended.

It is indeed rare to find so well-balanced a contribution to mineralogy. It will appeal to the collector, for it tells what minerals to look for, where to look, and why (paragenetically). It contains full chemical and crystallographic descriptions

for those interested in compiling such data. But best of all is the way in which optical data are presented, not merely as a matter of record, but to throw light upon the compositions and natures of the more complex minerals of the region.

W.

NEW MINERALS—NEW SPECIES

FAMILY: PHOSPHATES, ETC. DIVISION: COLLOIDAL $X(\text{Al}_2\text{O}_3 + \text{AlF}_3) + y \text{P}_2\text{O}_5 + z \text{H}_2\text{O}$.

Unnamed.

OSKAR GROSSPIETSCH: Ein Tonerdephosphat von Arsita bei Jakubeny, Bukowina. (An aluminium phosphate from Arsita near Jakubeny, Bukowina.) *Verh. geol. Reichsanst. Wien*, 1919, (6), 149-155.

CHEMICAL PROPERTIES: Analysis (judging from the summation not very accurate, and definitely stated to be "apparently inexact" as to fluorine) gave: Al_2O_3 35.06, Fe_2O_3 0.91, MnO trace, SiO_2 4.23, P_2O_5 28.18, F 4.40, H_2O 28.70, absorbed moisture 6.44, sum 107.92%. From this a highly complex constitutional formula is derived. It approximates $3\text{Al}_2\text{O}_3 \cdot \text{AlF}_3 \cdot 2\text{P}_2\text{O}_5 \cdot 15\text{H}_2\text{O}$, the theory for which is Al_2O_3 32.4, AlF_3 8.9, P_2O_5 30.1, H_2O 28.6, sum 100.0%; or Al_2O_3 37.8, F 6.0, P_2O_5 30.1, H_2O 28.6, less O = F 2.5, sum 100.0%.

PHYSICAL PROPERTIES: Color almost pure white; colloidal, dense; sp. gr. 1.998.

OCCURRENCE: A decomposition product of manganese silicate ores, associated with wad and limonite. Found at Oberarsita, near Jakubeny, Bukowina.

DISCUSSION: Has been described as planerite (Leitmeier, *Z. Kryst. Min.* 55, 353, 1916; abstd. in *Am. Min.* 1, 34, 1916) but is thought to differ in composition and properties. However, too much reliance should not be placed on analytical data obtained from colloid minerals.

E. T. W.

FAMILY: SULFIDES, ETC. SUBFAMILY: HYDROCARBONS.

DIVISION: $\text{R}' : \text{R}''' = 4:3$.

Simonellite.

R. CIUSA AND A. GALIZZI: Ricerche su alcuni costituenti delle ligniti. [An investigation of certain constituents of lignites]. *Gazzetta Chimica Italiana*, 51, (1), 55-60, 1921; thru *Min. Abstr.* 1, 202, 1921.

CHEMICAL PROPERTIES: *Formula*, probably $\text{C}_{15}\text{H}_{20}$. Analysis gave: C 89.84%, H 10.15%; mol. wt. 202-213. The mineral is soluble in benzene or ethyl acetate, but only slightly in alcohol. M. p. = $61-2^\circ$, b. p. $314-6^\circ$.

CRYSTALLOGRAPHIC PROPERTIES: Orthorhombic; $a:b:c = 0.9908:1:1.9694$ (G. Boeris). Forms: (001), (111), and (221).

PHYSICAL PROPERTIES: A white crystalline encrustation.

OCCURRENCE: On lignite from Fognano, Montepulciano, Tuscany. This lignite yields liquids with the composition $\text{C}_{15}\text{H}_{23}$ and $\text{C}_{15}\text{H}_{26}$. Lignite from Terni contains feathery masses of crystalline plates, $\text{C}_{20}\text{H}_{34}$, m. p. $74-5^\circ$, which may be *hartite*.

DISCUSSION: Probably a valid species, altho optical data are lacking.

E. F. H.

FAMILY: OXIDES. SUBFAMILY: HYDROXIDES. DIVISION:
 $R'''' : O:H_2O = 1:3:X$

Becquerelite.

ALFRED SCHOEP: Sur la becquerélite, nouveau minéral radioactif. (Becquerelite, a new radioactive mineral.) *Compt. rend.*, 174, (19), 1240-1242, 1922.

NAME: In honor of A.-Henri *Becquerel*.

CHEMICAL PROPERTIES: *Formula*, $UO_3 \cdot xH_2O$. Material was dried at 100°, losing 4.21% H_2O , and then analyzed, the average of two closely agreeing trials giving: UO_3 86.51, H_2O 5.82; Fe_2O_3 0.54, PbO 5.25, SiO_2 0.83, SO_3 1.01, sum 99.96%. The PbO and SO_3 come from admixed anglesite, the Fe_2O_3 and SiO_2 are evidently impurities; the total H_2O value (both + and - 100°) represents approximately 2 H_2O , (theory 11.2%), but the rôle of this constituent needs further study. The radioactivity is about the same as that of pitchblende.

CRYSTALLOGRAPHIC AND OPTICAL PROPERTIES: System orthorhombic. Prism zone angles within 1-2° of 60°, and twins of aragonite type are common. Crystals minute. Cleavage perfect on 001 and 110. A biaxial interference figure is shown on basal cleavage flakes. $\alpha = 1.75$, $\gamma = 1.77$, sign -. Pleochroic from nearly colorless to deep yellow.

PHYSICAL PROPERTIES: Color brownish yellow; luster resinous.

OCCURRENCE: Associated with curite, soddite, and anglesite in cavities in pitchblende at Kasolo, Belgian Congo.

DISCUSSION: The name "lambertite" has been given to a mineral alleged to be UO_3 found in Wyoming in 1919 (See *Am. Min.*, 5, (1), 17-18, 1920.). Its properties were, however, not described, so that it is impossible to state whether it is identical with the present mineral or not. Should the two, as seems likely, ultimately prove to be the same, an awkward nomenclatorial situation will arise: Shall that name be used which has priority in date, or that which has priority in description? In the biological sciences the latter would be selected, and the abstractor is inclined to favor the same plan here.

E. T. W.

FAMILY: SILICATES. DIVISION: $UO_3:SiO_2:H_2O = 5:2$: 6 (?).

Soddite.

ALFRED SCHOEP: La soddite, nouveau minéral radioactif. (Soddite, a new radioactive mineral.) *Compt. rend.*, 174, (16), 1066-1067, 1922.

NAME: Dedicated to Frederick *Soddy*.

CHEMICAL PROPERTIES: *Formula*, perhaps $5UO_3:2SiO_2:6H_2O$, or $(UO_2)_6 [6H_2O] Si_2O_9$, for which the theory is UO_3 86.2, SiO_2 7.3, H_2O 6.5%. [The author gives a more complex formula, but too great dependence should not be placed on analyses made on minute amounts of material, separated from intimately admixed impurities.] The average of several partial analyses gave: UO_3 85.33, SiO_2 7.83, Fe_2O_3 0.40, H_2O 6.23, sum 99.79%.

Before the blowpipe soddite is infusible; in the closed tube it blackens, losing H_2O and O. It dissolves in HCl with gelatinization. Its radioactivity corresponds to the high content of U.

CRYSTALLOGRAPHIC AND OPTICAL PROPERTIES: System orthorhombic; habit prismatic, with a flat prism, striated vertically. Crystals minute. The optic axial plane is (010) and $\gamma = c$, $\beta = 1.64$, $\gamma = 1.68 \pm 0.025$.

PHYSICAL PROPERTIES: Color dull yellow; streak pale yellow; translucent to opaque; $H.=3-4$; $D.=4.627$.

OCCURRENCE: Intimately mixed with curite (see *Am. Min.*, **7**, (7), 128, 1922) at Kasolo, Belgian Congo.

DISCUSSION: Evidently a valid new species, but further data on its composition and properties are desirable. E. T. W.

DOUBTFUL SPECIES

FAMILY: SULFIDES AND RELATED COMPOUNDS. DIVISION:

$R'': R''' = 3:1$ (?)

Unnamed.

O. HACKL: Ein neues Nickel-Arsen-Mineral. (A new nickel-arsenic mineral.) *Verhandlung der Geologischen Staatsanstalt Wien*, 1921, (7-8), 107-108.

CHEMICAL PROPERTIES: *Formula*, approximating Ni_3As , for which the theory is: Ni 70.1, As 29.9%. The amount of material available was very small, but analysis gave: Ni 67.11, Co 1.29, Fe 0.61, Cu 0.99, Ag 0.02, As 30.64, sum 100.66%.

CRYSTALLOGRAPHIC PROPERTIES: Crystallizes in cubes 5 mm. on a side.

PHYSICAL PROPERTIES: Color grayish white; luster metallic.

OCCURRENCE: Found in the vicinity of Radstadt, Salzburg, by Prof. C. Diener.

DISCUSSION: May well await the finding and investigation of further material before acceptance as a new species. E. T. W.

FAMILY: SILICATES. $R' + R'': R''' + R'''' = 1:4$

"Oranite"

HAROLD L. ALLING: The mineralography of the feldspars. *J. Geol.* **29** (3), 237, 1921.

NAME: An abbreviation of *orthoclase*—*anorthite*, with the mineralogical termination *ite*.

CHEMICAL PROPERTIES: A more or less hypothetical intergrowth of orthoclase (or microcline) and anorthite corresponding to plagioclase, ranging in composition from $Or_{70}An_{30}$ to $Or_{20}An_{80}$. Members with less than 30 An, are to be called "lime orthoclase," with more than 80 Ab, "potash anorthite."

CRYSTALLOGRAPHIC AND PHYSICAL PROPERTIES: Unknown.

OCCURRENCE: Extremely rare in nature, if it exists at all. Alling's tabulations of many hundreds of feldspar analyses show only 2 or 3 which appear to belong here.

DISCUSSION: Whether this should be considered a mineral species or a group is not clear. The name seems unfortunate, as it looks so much like "granite" that it is sure to be set up thus by many compositors. Moreover, if not a species, it should not end in *ite*. E. T. W.

FAMILY: CARBONATES. DIVISION: $R'': R''': H_2O = 2:1:1$

"Paraurichalcite"

F. K. BIEHL: Beiträge zur Kenntnis der Mineralien der Erzlagerstätten von Tsumeb. [Contributions to the knowledge of the ore deposits of Tsumeb.] *Inaug.-Diss. Munster (Westf.)*, 1919, 59 pp.; thru *Min. Abstr.* **1**, 202-3, 1921.

NAME: From *para* and *aurichalcite*.

CHEMICAL PROPERTIES: The author assigns a variable composition between the limits $3\text{RCO}_3 \cdot 4\text{R}(\text{OH})_2$, and $4\text{RCO}_3 \cdot 5\text{R}(\text{OH})_2$, with $\text{R} = \text{Cu}:\text{Zn} = 2:1$ to $3:2$. The evidence seems insufficient, however, to justify such complex formulas.

PHYSICAL PROPERTIES: Botryoidal, bead-like or earthy, resembling malachite in appearance, structure, and bluish-green color. Sp. gr. 4.14–4.20, H. 4–5.

OCCURRENCE: Formed at Tsumeb, by the action of zinc-bearing solutions on malachite. Sometimes contains an unaltered core of the latter.

EDW. F. HOLDEN.

"Cuprozincite"

BIEHL: *op. cit.*

NAME: From *cuprum* (copper) and *zincite*.

CHEMICAL PROPERTIES: Formula: $\text{RCO}_3 \cdot \text{R}(\text{OH})_2$, with $\text{R} = \text{Cu}:\text{Zn} = 9:2$.

OPTICAL PROPERTIES: Identical with malachite, therefore described as monoclinic.

PHYSICAL PROPERTIES: Sp. gr. 4.10, H. 3; otherwise like paraurichalcite.

OCCURRENCE: As with paraurichalcite.

DISCUSSION: These two basic copper-zinc carbonates are imperfectly described; they vary in composition, and are apparently impure. They are best regarded as somewhat altered zinc-bearing malachites. Compare rosasite, *Am. Min.*, 6, 166, 1921.

E. F. H.

FAMILY: PHOSPHATES, ARSENATES, ETC. DIVISION: NEAR

$\text{R}'': \text{R}''': \text{H}_2\text{O} = 2:1:1$

"Parabayldonite"

BIEHL: *op. cit.*

NAME: From *para* and *bayldonite*.

CHEMICAL PROPERTIES: A theoretical molecule, $\text{R}_3\text{As}_2\text{O}_8 \cdot \text{R}(\text{OH})_2 \cdot \frac{1}{2}\text{H}_2\text{O}$, $\text{R} = \text{Cu}$ and Pb ; assumed to be present with bayldonite in a group of Cu-Pb arsenates of variable composition.

PHYSICAL PROPERTIES: These arsenates are greenish cellular masses and pseudomorphous crusts; sp. gr. approx. 5.5.

OCCURRENCE: At Tsumeb, presumably secondary after cerussite.

E. F. H.

"Cuproplumbite". (Used in a new sense.)

BIEHL: *op. cit.*

NAME: From *cuprum* (copper) and *plumbum* (lead), with the termination *ite*.

CHEMICAL PROPERTIES: Formula: $2\text{R}_3\text{As}_2\text{O}_8 \cdot 3\text{R}(\text{OH})_2 \cdot \text{XH}_2\text{O}$, with $\text{R} = \text{Cu}$ and Pb ; $\text{X} = 0, 1$, or 2 .

OTHER PROPERTIES: As with parabayldonite.

OCCURRENCE: Alteration product of mimetite.

DISCUSSION: The name cuproplumbite has previously been used (Dana's System, 6th ed., p. 51), for a copper-lead sulfide. "Parabayldonite" and "cuproplumbite" are variable, and too near bayldonite to be accepted as species.

In the same paper are described: lead oxides; cerussite; smithsonite; malachite; azurite crystals with $a, c, v, m, l, f, p, h, \theta, \eta, \sigma$; aurichalcite; brochantite [forms b, m, v, x and (*new*) (301), (430)]; mimetite (forms c, m, x ;) and olivenite (forms m, e, a).

E. F. H.

ABSTRACTS—CRYSTALLOGRAPHY

DETERMINATION OF THE SYMMETRY AND THE ELEMENT P₀ OF MOLYBDOPHYLLITE BY MEANS OF ROENTGEN RAYS. G. AMINOFF. *Geol. För. Förh.*, **40**, 923-38, 1918; *ibid.*, **41**, 213-4, 1919; thru *Min. Abst.* **1**, 182, 1921.

Molybdophyllite is probably ditrigonal-scalenohedral, isomorphous with friedelite, and has $a:c=1:0.549$, as determined from the Laue diagram thru the basal pinacoid.
EDW. F. HOLDEN.

A NEW POLARIZATION MICROSCOPE AND A CRITICAL CONSIDERATION OF PREVIOUS CONSTRUCTIONS. E. A. WÜLFING. *Abh. Heidelberger Akad. Wiss., Stiftung, H. Lanz. Math.-nat. Kl.*, **1918**, *abh.* 6; thru *Neues Jahrb. Min. Geol.*, **1919**, Ref. 247-50.

This paper discusses fully previous types of polarization microscopes, and presents a new type for consideration.
E. F. H.

THE OPTICAL BEHAVIOR OF WATER OF CRYSTALLIZATION. K. BRIEGER. *Ann. Phys.*, **57**, 287-320, 1918; thru *Chem. Abst.* **13**, 3076, 1919.

An examination of the reflecting power of a number of hydrated sulfates and selenates showed the H₂O group to be arranged in the space lattice.
E. F. H.

THE DETERMINATION OF ATOMIC WEIGHTS BY MEANS OF X-RAYS. C. W. KANOLT. *Science*, **47**, 123-4, 1918.

This is a proposal to calculate the atomic weights from the density and an X-ray study of the crystalline structure of the elements.
C. B. S.

THE DERIVATION OF THE CRYSTAL LATTICE STRUCTURE FROM THE ROENTGEN-LAUE EFFECT. H. TERTSCH. *Min. petr. Mitt.*, **34**, 1, 1917; thru *Neues Jahrb. Min. Geol.*, **1919**, Ref. 123-5.

This is a discussion of the several alternative interpretations of crystal structure often possible from the results of the X-ray method.
E. F. H.

CRYSTAL STRUCTURE AND CHEMISM. P. NIGGLI. *Vierteljahrsschrift Naturf. Ges.*, **62**, 242-74, 1917; thru *Neues Jahrb. Min. Geol.*, **1919**, Ref. 257-8.

A number of problems and relationships in the study of crystal structure are discussed in this very theoretical paper.
E. F. H.

COHESION, CONDUCTIVITY, AND CRYSTAL STRUCTURE. A. JOHNSEN. *Sitzungsb. bayr. Akad. Wiss., Math.-phys. Kl.*, **1917**, 75-82; thru *Neues Jahrb. Min. Geol.*, **1919**, Ref. 13-5.

According to J. cleavage does not always take place along the planes of maximum density of the units of crystal structure, and to explain these cases he uses another hypothesis, supporting the theoretical conclusions with references to the directions of maximum conductivity in crystals.
E. F. H.

DATOLITE FROM RODELLA NEAR CAMPITELLO. R. KOECHLIN. *Ann. Naturhist. Hofmuseums Wien*, **31**, 139-46, 1917; thru *Min. Abst.*, **1**, 153, 1921. Datolite crystals from this locality in the Fassathal showed nine new forms; $\bar{j}$ (243), x_e (816), x_g (725), M_2 (153), (3.13.7), (423), (543), (365) and (485) (Goldschmidt's orientation).
E. F. H.

ANISOTROPIC COLLOIDAL SOLUTIONS. W. REINDERS. *Koll. Z.*, **21**, 161-5, 1917; thru *Neues Jahrb. Min. Geol.*, **1919**, Ref. 2.

The anisotropism of colloidal solutions of vanadium pentoxide is due to the presence of extremely small crystals of the oxide, held in suspension with the colloidal particles.

E. F. H.

THE ADSORPTION OF SULFURIC ACID BY IRON HYDROXIDE AND THE FORMATION OF COLLOIDAL SULFUR FROM SULFIDES. E. DITTLER. *Z. Chem. Ind. Koll.*, **21**, 27-8, 1917; thru *Neues Jahrb. Min. Geol.*, **1919**, Ref. 135-6.

Weathered pyrite and marcasite have been observed to contain some free sulfur.

E. F. H.

THE STRUCTURE OF UNHOMOGENEOUS LIQUID-CRYSTALLINE LAYERS. O. LEHMANN. *Ann. Phys.*, (4) **52**, 445-77, 1917; thru *Neues Jahrb. Min. Geol.*, **1918**, Ref. 255.

Unhomogeneous liquid-crystalline layers occur when the liquid crystals are in contact with differently oriented anisotropic solid surfaces.

E. F. H.

THE STRUCTURE OF CRYSTAL PLANES AND EDGES. A. JOHNSEN. *Neues Jahrb. Min. Geol.*, **1918**, 49-74.

A general theoretical discussion is followed by an application to the structure of certain faces and edges in fluorite.

E. F. H.

A NEW METHOD FOR MEASURING THE VELOCITY OF CRYSTALLIZATION OF METALS. J. CZOHRALSKI. *Z. phys. Chem.*, **92**, 219-21, 1917; thru *Neues Jahrb. Min. Geol.*, **1919**, Ref. 122.

In opaque fusions it is possible to measure the velocity of crystallization by withdrawing thin threads of the substance, and finding the highest velocity at which it is possible to accomplish this without breaking the thread.

E. F. H.

ANOMALOUS MOLECULAR ARRANGEMENT IN MIXED CRYSTALS AS A CAUSE OF THEIR ANOMALOUS DOUBLE REFRACTION. G. TAMANN. *Nachr. Ges. Wiss. Göttingen, Math.-phys. Kl.*, **1917**, (2) 226-35; thru *Neues Jahrb. Min. Geol.*, **1919**, Ref. 262-3.

T. regards optically anomalous mixed crystals as isomers of the normal mixed crystals, the cause being a different distribution of the molecules in a similar space lattice.

E. F. H.

THE CRYSTALLOGRAPHIC AND OPTICAL PROPERTIES OF AMYROLIN. HERMANN ROSE. *Neues Jahrb. Min. Geol.*, **1918**, 1-18.

Sp. gr. 1.3506 at 18° (pycnometer). Monoclinic, $a:b:c=0.7583:1:1.1106$; $\beta=76^{\circ}55'$. Double refraction and dispersion very high; for sodium light, $\alpha=1.46447$, $\beta=1.74798$, $\gamma=1.94579$, $\gamma-\alpha=0.48132$; for light of 690.7μ $\gamma=1.91379$, for 404.7μ $\gamma=2.19889$. Composition $C_{14}H_{12}O_3$.

E. F. H.

CHUBUTITE AND THE SIGNIFICANCE OF ITS DISCOVERY. E. RIMANN. *Anales Soc. Quim. Argentina*, **6**, 323-8, 1918; thru *Min. Abst.*, **1**, 121, 1921. R. suggests that the dimorphism of PbO persists in the series of lead oxy-chlorides.

E. F. H.

THE CRYSTALLOGRAPHY AND OPTICAL PROPERTIES OF THE PHOTSENSITIZING DYE PINAVERDOL. EDGAR T. WHERRY AND ELIOT Q. ADAMS. *J. Wash. Acad. Sci.*, **9** (14), 397-405, 1919.

The crystallization is monoclinic, but so near other systems that it is best described as "lepto-monoclinic, but peri-rhombic"; it may also be classed as hypo-tetragonal. This substance is one of the few which shows reflection pleochroism, or reflection of light of different colors from the several crystal forms. The prism zone is brass yellow, the base and forms near it violet, and forms in intermediate positions show varying green colors, the yellower the greater the ρ angle. When studied by the immersion method under the microscope striking absorption phenomena were observed. By means of crystallographic measurement it was possible to demonstrate the identity of samples from widely different sources, which looked in mass to be of various colors, depending on which forms were dominant in each case.

E. T. W.

THE CRYSTALLOGRAPHY OF MORPHINE AND CERTAIN OF ITS DERIVATIVES. EDGAR T. WHERRY AND ELIAS YANOVSKY. *J. Wash. Acad. Sci.*, **9** (17), 505-513, 1919.

Measurements of the crystallography and optical properties are given in detail for morphine monohydrate, codeine, codeine monohydrate, codethyline monohydrate, and heroine. The last two, never having been measured previously, are figured; both are orthorhombic, the first probably and the second strikingly sphenoidal. The topic axial ratios are calculated, and it is shown that it is possible thereby to determine in which crystallographic directions substitutions of elements or groups occur, and where water of crystallization enters the crystal.

E. T. W.

A CRYSTALLOGRAPHIC INVESTIGATION OF BRANDTITE. G. AMINOFF. *Geol. Fören. Förh.*, **41**, 161-174, 1919; thru *Chem. Abstr.*, **14** (8) 1098, 1919.

Brandtite, $\text{Ca}_2\text{MnAs}_2\text{O}_8 \cdot 2\text{H}_2\text{O}$, is monoclinic, $a:b:c=0.8720:1:0.4475$, $\beta=99^\circ 37'$. Eleven forms were noted. Twinning plane (100), good cleav. parallel to (010). Plane of optic axes is (010) and a max. extinction angle of 8° was noted. Optically +; $\alpha=1.707$, $\gamma=1.729$.

W. F. H.

ORTHOCLASE CRYSTALS FROM ZARZALEJO, MADRID. NAVARRO L. FERNÁNDEZ. *Bol. Soc. Españ. Hist. Nat.*, **19**, 137-143, 1919; thru *Min. Abstr.*, **1**, 13, 1920.

Simple crystals possess a square prismatic habit or are flattened parallel to b . Twins according to the Carlsbad, Mannebach and Baveno laws are described. The crystals are found detached on the surface having been derived from a coarse, porphyritic dike, 50 m. north of Madrid.

W. F. H.